

levels, transmit GAP levels, receipt of GAP levels by other devices in the system, initiate their decision processes and for appliances to apply their load after having power returned. This response time can be assumed to be somewhere between a fraction of a second and a few seconds. The GAP power levels may be transmitted by transmissions to receivers in the system via any of a number of networking protocols and communication media.

For facilities being powered by renewable energy sources, the total system power varies with the amount of electricity stored in batteries and the electricity being generated by solar panels, wind powered generators, hydro generators, etc. Given that such systems contain multiple components for generating and storing energy, and each of these components has its own performance and efficiency characteristics, the optimum level of electric output for a given system can vary with certain factors such as the state of charge in the storage system, the intensity, angle and/or strength of the suns rays striking the solar panels, the speed and/or force of the wind driving the wind powered generators, the height of the water column driving the hydroelectric generators, etc. If the renewable energy system is designed to determine its own optimum power output for a given operating condition, this power output can be communicated to the generator monitor 10. This optimum power output could be used to calculate the various reference outputs used by the generator monitor, such that the generator monitor 10 tracks the dynamic capability of a power source rather than using set reference outputs determined from the fixed generating capacity of a combustion engine powered generator. This allows the user to optimize the reference outputs and associated GAP levels to the power source's most efficient operating level.

In some instances, electrical loads are programmed to operate at scheduled times during the day. For example, an electric hot water heater can be placed on a timer that activates the water heater during specified intervals. The intent is to heat water during off peak periods for the purpose of reducing peak loads on the electric utility. Timed loads can be managed by the invention by adjusting reference outputs on the generator monitor 10 by time of day. As mentioned previously, the invention uses other devices that control the

use of appliances in the facility. The function of these other devices will be explained in detail later. Briefly however, a device referred to as and “interrupt switch” will interrupt the power to an appliance whenever the load of the appliance is larger than the GAP or latent generating capacity. By interrupting power to the appliance, the appliance cannot activate when its electric load level can overload the generator and trip the circuit breaker. However, for a timed load such as the hot water heater, its predictability allows for the load to be managed solely by the generator monitor 10 and avoid the need for an interrupt switch. Programming the generator monitor 10 to lower some, or all of the reference outputs by the amount of the load, for the time and duration of the load, accommodates the timed load. Lowering the reference outputs reserves the power required by the timed load and prevents the other devices and appliances in the facility from detecting and using this reserved power. Lowered reference outputs cause the calculation of GAP levels to be lower and in turn the transmitted GAP levels in transmissions 17 of Figure 1 report lower Generator Available Power, GAP, to the other devices in the system. The lower GAP levels prevent the other devices from accessing the power being used, or about to be used, by the timed load. The actual timing of the reduction in reference outputs is dependent on the nature of the load cycle executed by the timed load. If the load is a constant load for a set time, the generator monitor 10 need only lower the reference outputs by the amount of the load for a few minutes prior to the starting of the timed load. The reference outputs are programmed to return to the original settings 5 to 10 minutes after the timed start of the timed load. If the load cycle changes during the timed load, then the reduction in reference outputs is lowered for the duration of the timed load. The need for the two processes for lowering reference outputs is clarified further with the explanation of the other devices in the system and how their processes react to each other.

In an alternate embodiment of the invention, the generator monitor 10 can execute on request, a power reduction that reduces the reference outputs for an identified period of time. This feature allows for an appliance that has varying loads during an operating cycle. An example of such an appliance is a washing machine, which draws higher power levels during wash and spin cycles, and lower power levels when filling and

draining water into and out of the machine. The request to the generator monitor 10 could come from any of the other devices, either a user display 30 or an interrupt switch 20, allowing the user to request a lowering of the reference outputs by the maximum load of the appliance, for a time period similar to or slightly longer than the cycle time of the appliance. By reducing the reference outputs from which GAP levels are calculated, this feature reserves the maximum load of the cycling appliance for the duration of the cycle by removing the power needed for the load, from the GAP reported to the other appliances.

The system of the present invention can support an additional level of power management by using two or more generator monitors 10a, 10b in Figure 1a, between the power source and the electrical loads in the home or facility. With one generator monitor 10, in the system Figure 1, power management is based on one measured load applied by the home. With two or more generator monitors 10a and 10b, in Figure 1a, measuring the loads of selected circuits in the home, the invention offers one more variable for increased control over the use of the generator's capacity.

In this embodiment, each generator monitor calculates independent GAP levels as described previously. Each generator monitor 10a, 10b, etc. could have multiple reference outputs, provided the sum of the highest reference outputs, set on each of the generator monitors, did not total more than the total capacity of the generator or power source.

An example of this is a home with a large generator capable of 7000 Watts surge and 6000 Watts continuous, supporting a large number of appliances that turn themselves on and off via their own internal control systems. Assume that the generator does not have an automatic starting system and must be started by the homeowner whenever there is a power failure. Also, assume the user does not notice a power failure for several hours, due to the power failure occurring when the user is asleep or away from the home. Upon returning, the user finds the home without power and proceeds to start the generator. Assume the home has a refrigerator, a freezer, well water pump, sump pump and furnace,